

Amendments to the Specification:

Please replace the paragraph beginning "Fig. 1C illustrates" that begins on page 6, line 14, of the specification with the following paragraph:

FIG. 1C illustrates a plan view of a two-terminal embodiment of phase shift device 123. Phase shift device 123 includes a heterostructure containing a Josephson junction 260 between two anisotropic superconductors 241 and 242. In some embodiments anisotropic superconductors 241 and 242 can be d-wave superconductors, such as $\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$, where $0 < d < 0.6$. Anisotropic superconductors 241 and 242 have crystal axis orientations θ and θ' with respect to the grain boundary, defining an angle of mismatch θ'' , where $\theta'' = \theta - \theta'$. In general, the crystal axis orientation of a superconductor correlates with the orientation of the order parameter of that superconductor. Modifying the angle of mismatch θ'' of anisotropic superconductors 241 and 242 with respect to grain boundary 260 affects the phase shift across the grain boundary [[260]]. For example, FIG. 1C illustrates a mismatch angle of $\theta'' = 45^\circ$, causing a $\pi/2$ -phase shift. The behavior of such junctions is well known, as described in detail by C. Bruder, A. van Otterlo, and G. T. Zimanyi in "Tunnel Junctions of Unconventional Superconductors," Phys. Rev. B 51, 12904-07 (1995), and by R. R. Schultz, B. Chesca, B. Goetz, C. W. Schneider, A. Schmehl, H. Bielefeldt, H. Hilgenkamp, J. Marnhart, and C. C. Tsuei in "Design and Realization of an all d-Wave dc π -Superconducting Quantum Interference Device," Applied Physics Letters, 76, p. 912-14 (2000), both publications incorporated hereby in their entirety by reference.

Please replace the paragraph beginning "In some embodiments, Josephson junction 260" that begins on page 7, line 1, of the specification with the following paragraph:

In some embodiments Josephson junction 260 is formed as a grain boundary junction. Superconductors often form on substrates so that the crystal axis orientation and thus the orientation of the order parameter of the superconductor is determined by the crystal axis orientation of the substrate. Therefore a grain boundary junction can be formed by depositing anisotropic superconductors ~~240~~ 241 and ~~241~~ 242 onto a bi-crystal

substrate with an existing lattice-mismatched grain boundary. The grain boundary of the bi-crystal substrate can force anisotropic superconductors ~~240~~ 241 and ~~241~~ 242 to form with crystal axis orientations that themselves form a grain boundary, creating a junction.

Please replace the paragraph beginning "In this embodiment anisotropic" that begins on page 7, line 15, of the specification with the following paragraph:

In this embodiment anisotropic superconductors ~~240~~ 241 and ~~241~~ 242 are coupled to superconducting terminals 210 and 211 by c-axis heterostructure junctions. The c-axis heterojunctions can be created by forming normal metal connectors 250 and 251 on anisotropic superconductors 241 and 242, respectively. Superconducting terminals 211 and 210 can subsequently be deposited over normal metal connectors 250 and 251. Finally, an insulating layer 50 can be formed overlying anisotropic superconductors 241 and 242, but having openings for superconducting terminals 210 and 211.

Please replace the paragraph beginning "Josephson junction 260" that begins on page 7, line 29, of the specification with the following paragraph:

Josephson junction 260 between anisotropic superconductors 241 and 242 can be a grain boundary. In some embodiments, junction 260 can be formed by using a bi-epitaxial method, where an anisotropic superconducting material is deposited onto substrate 90 that is partially covered by a seed layer. When the anisotropic superconductor is deposited on the substrate and the seed layer, it will grow with crystal axes determined by the crystal axes of the underlying angles. The crystal axis of the seed layer can be oriented with an orientation different from the orientation of the crystal axis of the substrate. In this case the anisotropic superconductor will grow with different crystal axis orientation on the seed layer and on the substrate itself. Therefore at the edge of the seed layer a grain boundary will be created within the anisotropic superconductor, forming in effect anisotropic superconductors ~~240~~ 241 and ~~241~~ 242. In some embodiments the substrate can be an insulator, for example, strontium titanate, and the seed layer can be CeO (cerium oxide) or MgO (magnesium oxide). Aspects of the fabrication of superconducting devices have been described, for example, by F. Tafuri, F.

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Carillo, F. Lombardi, F. Miletto Granozio, F. Ricci, U. Scotti di Uccio, A. Barone, G. Testa, E. Samelli, J. R. Kirtley in "Feasibility of Biepitaxial $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ Josephson Junctions for Fundamental Studies and Potential Circuit Implementation," Los Alamos preprint cond-mat/0010128 (2000), incorporated hereby in its entirety by reference.